OXYCOM
SUSTAINABLE AIR CONDITIONING

OXYCOM SELECTOR
USER GUIDE

OXYCOM FRESH AIR BV
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CONTENTS

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SECTION 1 – GENERAL

1.1 Introduction

OXYCOM Selector is an online tool that helps you selecting the right OXYCOM heat exchanger for your purpose. It allows you to analyse the cooling performance or heat recovery efficiency based on inlet air conditions and airflow, which are both user-definable.

1.2 Purpose

The Selector has especially been designed to assist our current and future partners getting a better insight in the functioning and performance of our technology. Although we designed it to be as easy accessible as possible, a certain level of knowledge in the field of thermodynamics, psychrometrics and evaporative cooling technology is recommended.

1.3 Functionality

The Selector offers three types of analyses: Standalone Performance, Applied Performance and Condenser Pre-cooling.
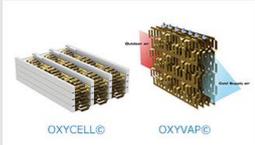
- The Standalone Performance allows you to select inlet air conditions (either user-defined or derived from a leading standard) and the type of OXYCOM heat exchanger. Your preferred airflow determines the cooling performance or heat recovery efficiency.

- The Applied Performance allows you to select a design condition from locations throughout the world. It then asks you to choose an OXYCOM technology and to dimension a certain space to be cooled. The Selector calculates the required amount of heat exchangers or heat exchanging surface area and shows the corresponding pressure drop, energy consumption, water consumption and energy efficiency.

- Condenser Pre-cooling is an easy applicable method to improve the efficiency of existing conventional air conditioning systems. OXYVAP direct evaporative cooling technology is used to pre-cool air before it enters the condenser coil, hereby decreasing the work that has to be done by the compressor and consequently increasing its efficiency.

Please note that the Selector is designed to operate within a certain bandwidth in which the user-specified parameters can be varied, to ensure accurate and reliable results. Should you like to perform an analysis outside the standard bandwidth, please contact our Research Manager: **mark.hakbijl@oxy-com.com**.
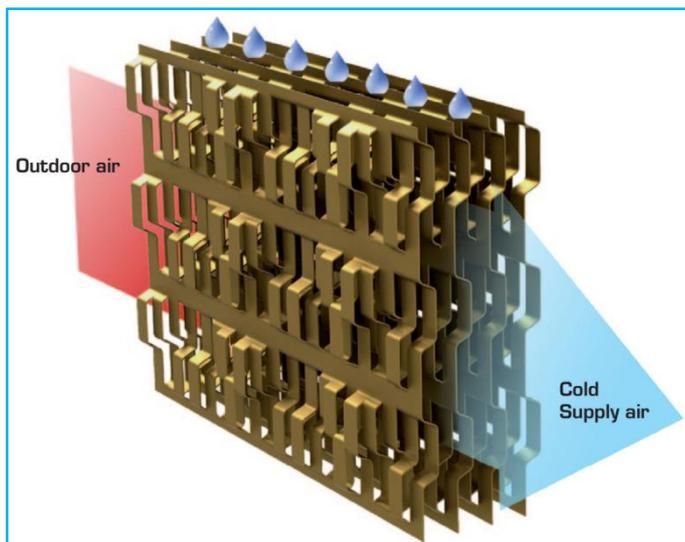
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SECTION 2 – TECHNOLOGY

2.1   OXYVAP – Direct Evaporative Cooling and Humidification

The OXYVAP pad is a modular "plug and play" high efficiency direct evaporative cooling pad including frame with integrated water distribution and collection functionality for use in compact direct evaporative cooling and humidification systems. Its modular design offers customers the necessary flexibility to accommodate for different airflow capacities as required in their product portfolios while maintaining the individual component performance characteristics.

The evaporative media is based upon our unique and patented water retaining finned aluminium sheet designed for maximum evaporation. Its superior evaporation efficiency allows for compact direct evaporative cooling systems with maximum cooling capacity whereas its design supports modular expansion combining two or more OXYVAP pads to meet any air capacity required for the system.

The OXYVAP can be applied in a wide variety of applications requiring cooling (residential buildings, air handling units for commercial/industrial buildings, livestock, horticulture) and/or humidification (residential/commercial/industrial buildings, process control).

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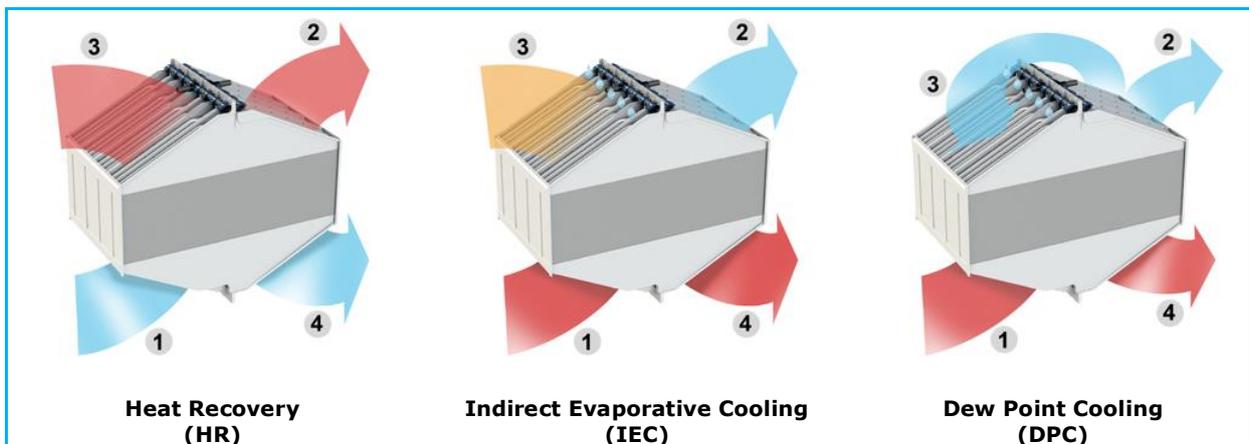Tel.: +31 (0)572 349400
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2.2 OXYCELL – Indirect Evaporative Cooling and Heat Recovery

The OXYCELL is the only heat exchanger that combines heat recovery with indirect evaporative cooling functionality. It's a unique single component providing an ALL SEASON solution for energy efficient ventilation, cooling and heat recovery.

The product has a modular design offering you the necessary flexibility to accommodate for different airflow capacities as required in your product portfolio while maintaining the individual component performance characteristics.

The OXYCELL can be used in three ways:

| Heat Recovery (HR) | Indirect Evaporative Cooling (IEC) | Dew Point Cooling (DPC) |

- **Heat Recovery (HR)** combines ventilation with minimisation of heat loss by regaining heat that would otherwise have been lost. It is used in a typical "winter" situation, when the outdoor temperature is substantially lower than the indoor temperature.

  1. Cold outdoor air.
  2. Warm supply air.
  3. Building waste air.
  4. Cold exhaust air.

- **Indirect Evaporative Cooling (IEC)** is a special form of Heat Recovery, in which air in the secondary (wet) channel is constantly being humidified and kept in a permanent state of saturation, hereby maximising the amount of heat that is being extracted from the primary (dry) channel, without increasing the humidity content of the primary airstream. It is used in a typical "summer" situation, in which cooling is desired.
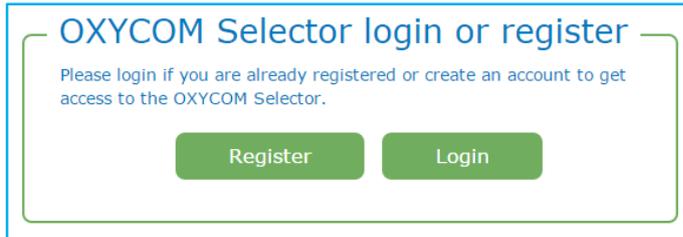
  1. Hot outdoor air.
  2. Cold supply air.
  3. Building waste air.
  4. Warm and humid exhaust air.

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- **Dew Point Cooling (DPC)** is a special form of Indirect Evaporative Cooling, in which part of the cooled air leaving the primary (dry) channel is branched off and led back into the secondary (wet) channel. It is used in a typical "summer" situation, in which cooling is desired. Compared to the Indirect Evaporative Cooling principle, it requires a larger primary airstream to provide an equal amount of supply air. Although strongly depending on the air conditions, in many cases it will provide a larger cooling effect than the Indirect Evaporative Cooling principle.

   1. Hot outdoor air.
   2. Cold supply air.
   3. Work air.
   4. Warm and humid exhaust air.

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SECTION 3 – GETTING STARTED

3.1   Registration and login

You can find the Selector at http://selector.oxy-com.com. On the home screen you can either create an account or login to your existing account.
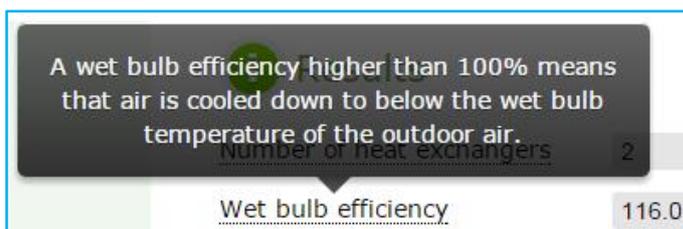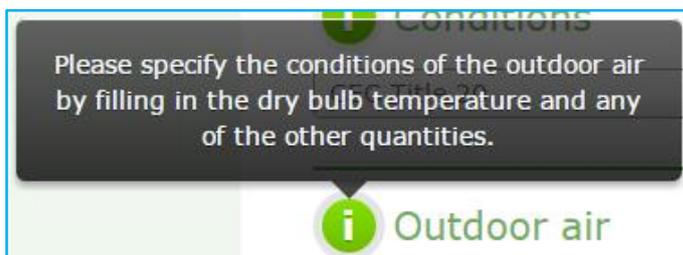

3.2   Main screen

On the main screen you can choose "Application" to start the actual Selector tool or "Saved configurations" to load previously selections that you may have saved.

3.3   General functions

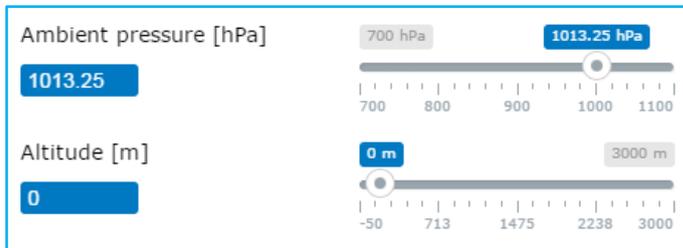The following general functions can be found throughout the Selector tool:

- The Selector offers extra information on many parameters, indicated by either an information sign or an underline.

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- It is possible to switch between the International System of Units (SI) and the American Inch-Pound System of Units (I-P).
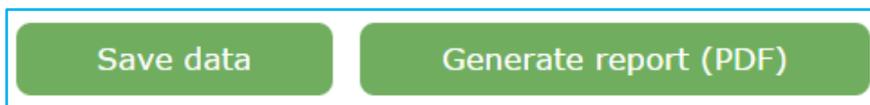

- You can specify either the altitude or the atmospheric pressure by filling in the desired value directly or by moving the sliders. If one of these values is changed, the other will be calculated accordingly. The default value is the standard sea-level pressure: 1013.25 hPa or 29.92 inHg.

- Buttons "Show Mollier diagram" and "Show Carrier diagram" show your choice of psychrometric diagram (Mollier or Carrier), graphically displaying the calculated cooling or heat recovery process.
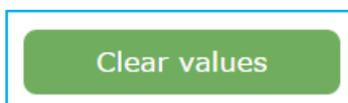

- It is possible to save the calculated data for future purposes or to generate a report in PDF format.

- To go back to a previous screen, please use the "Back" button at the bottom of the screen, rather than the browser built-in back button.
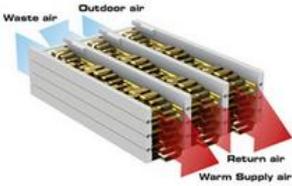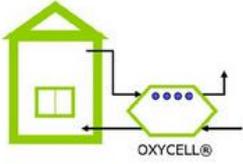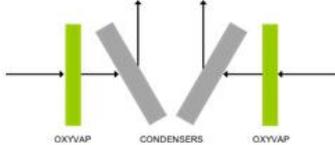

- Should you like to reset the numbers on the active screen to the default values, you can use the "Clear values" button.
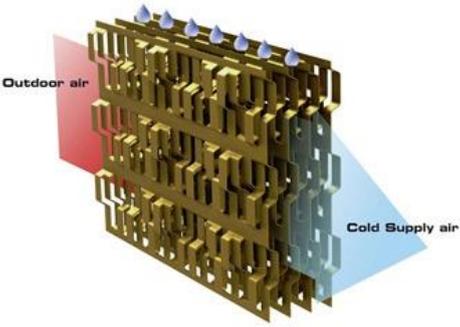
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SECTION 4 – STANDALONE OXYCELL HR EXAMPLE

4.1 Screen "Choose the application"

Please select the application "Standalone Performance".

4.2 Screen "Choose the technology"

Please select the technology "OXYCELL".

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4.3   Screen "Choose the usage"

Please select the usage "Heat Recovery".

Heat Recovery

Heat recovery is used in a typical "winter" situation, when the outdoor temperature is substantially lower than the indoor temperature.

Select

Dew Point Cooling

Dew point cooling is a special form of indirect evaporative cooling, in which part of the cooled supply air is branched off and led back into the wet channel.

Select

Indirect Evaporative Cooling

Indirect evaporative cooling is used in a typical "summer" situation, in which cooling is desired. Fresh supply air is cooled by the evaporation of water in the return air, without increasing the indoor humidity level.

Select

4.4   Screen "Air inlet conditions"

This screen allows you to specify the conditions of the airstreams flowing into the OXYCELL heat exchanger.

▪   You can select one of the most common standard conditions for testing the heat recovery efficiency. NEN-EN 308-1997 is used as default.

ℹ Conditions

NEN-EN 308-1997

NEN-EN 308-1997
Eurovent RS 8/C/001-2009 (min. condensation)
Eurovent RS 8/C/001-2009 (max. condensation)
ANSI/AHRI Standard 1060-2013
NEN 5138:2004

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- Alternatively, you can manually specify the conditions of the "Outdoor air" (the airstream that is being heated up) and the "Return air" (the airstream that is being cooled down) by choosing the dry bulb temperature and any of the other quantities.

4.5   Screen "Model and airflows"

This screen allows you to select the OXYCELL heat exchanger model, specify the airstreams and generate the results.

- In panel "Models" you can choose the model of the OXYCELL unit, of which the model number represents the maximum airflow that can be supplied, expressed in m^3/h.
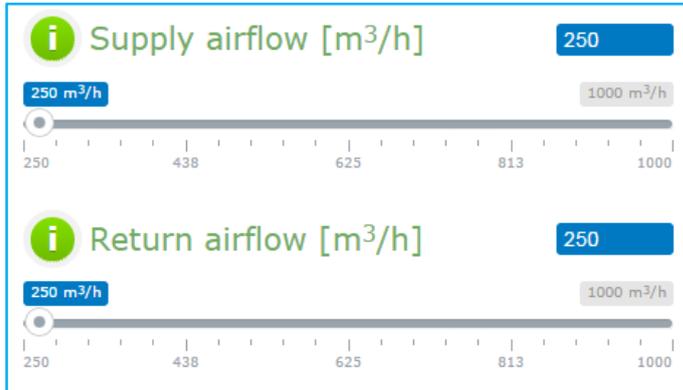
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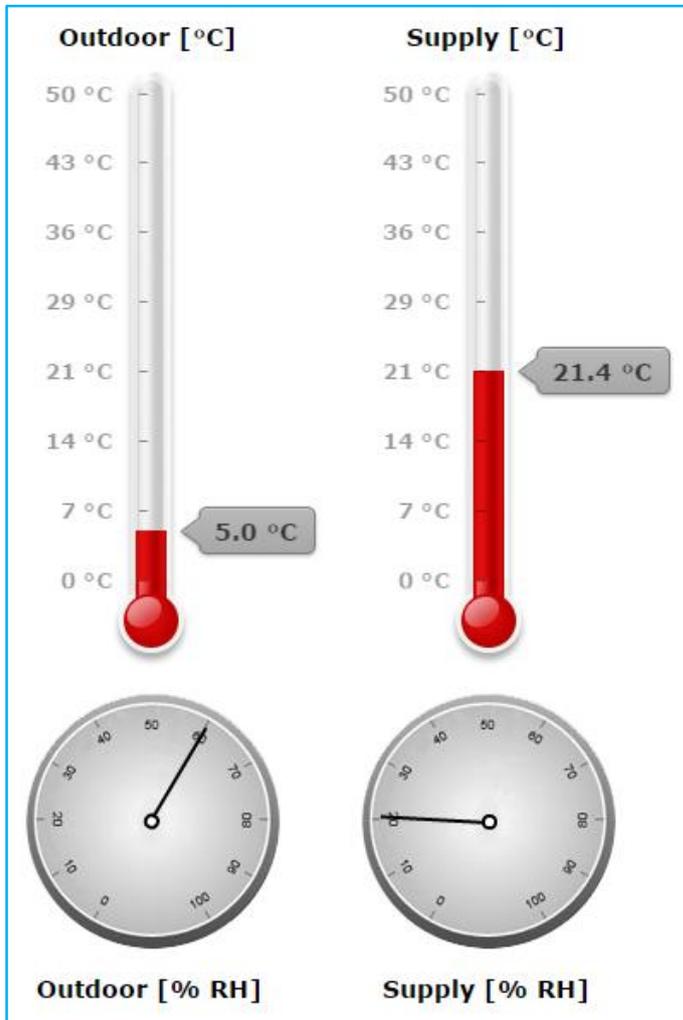Fax: +31 (0)572 349409

- In panels "Supply airflow" and "Return airflow" you can specify the amount of heated air that is supplied, as well as the amount of air that is returned (for example from a room, office or datacentre).

- The "Supply airflow" is the amount of heated air leaving the primary channel of the OXYCELL.

- The "Return airflow" is the amount of air that flows into the secondary channel of the OXYCELL, from which heat is being extracted and transported to the primary channel.

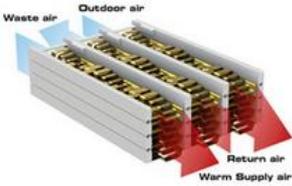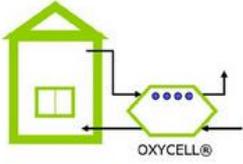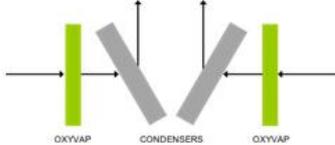- Panel "Results" shows an overview of the most interesting data.

- The panel at the right-hand side of the screen shows the (dry bulb) temperature and relative humidity of the outdoor and supply airstreams.
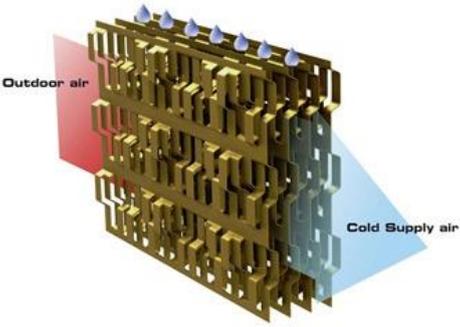
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SECTION 5 – STANDALONE OXYCELL DPC EXAMPLE

5.1   Screen "Choose the application"

Please select the application "Standalone Performance".

Standalone Performance

Cooling characteristics of the OXYCELL indirect evaporative cooler and the OXYVAP direct evaporative cooler.

Select

Applied Performance

The OXYCELL indirect evaporative cooler and the OXYVAP direct evaporative cooler applied to cool a room under certain outdoor design conditions and heat load.

Select

Condenser Pre-cooling

The OXYVAP direct evaporative cooler applied to lower the inlet air temperature to the condenser coils of a conventional air conditioning system, hereby increasing the compressor efficiency.
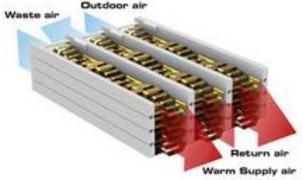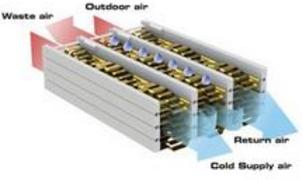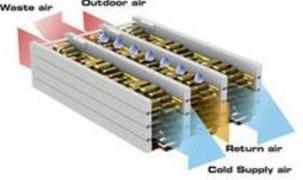
Select

5.2   Screen "Choose the technology"

Please select the technology "OXYCELL".

OXYCELL

The OXYCELLis a counter-flow heat exchanger, designed for heat recovery, indirect evaporative cooling and dew point cooling.

Select

OXYVAP

The OXYVAP is a direct evaporative cooling pad.

Select

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5.3   Screen "Choose the usage"

Please select the usage "Dew Point Cooling".

5.4   Screen "Air inlet conditions"

This screen allows you to specify the conditions of the airstream flowing into the OXYCELL dew point cooler.

- You can select one of the most common standard conditions for testing the efficiency of the cooling process. CEC Title 20 is used as default.

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- Alternatively, you can manually specify the conditions of the "Outdoor air" (the airstream that is being cooled down) by choosing the dry bulb temperature and any of the other quantities. The conditions for the "Return air" are not relevant for this type of cooling, and therefore cannot be specified.

5.5   Screen "Model and airflows"

This screen allows you to select the OXYCELL dew point cooler model, specify the airstreams and generate the results.

- In panel "Models" you can choose the model of the OXYCELL unit, of which the model number represents the maximum airflow that can be supplied, expressed in m^3/h.

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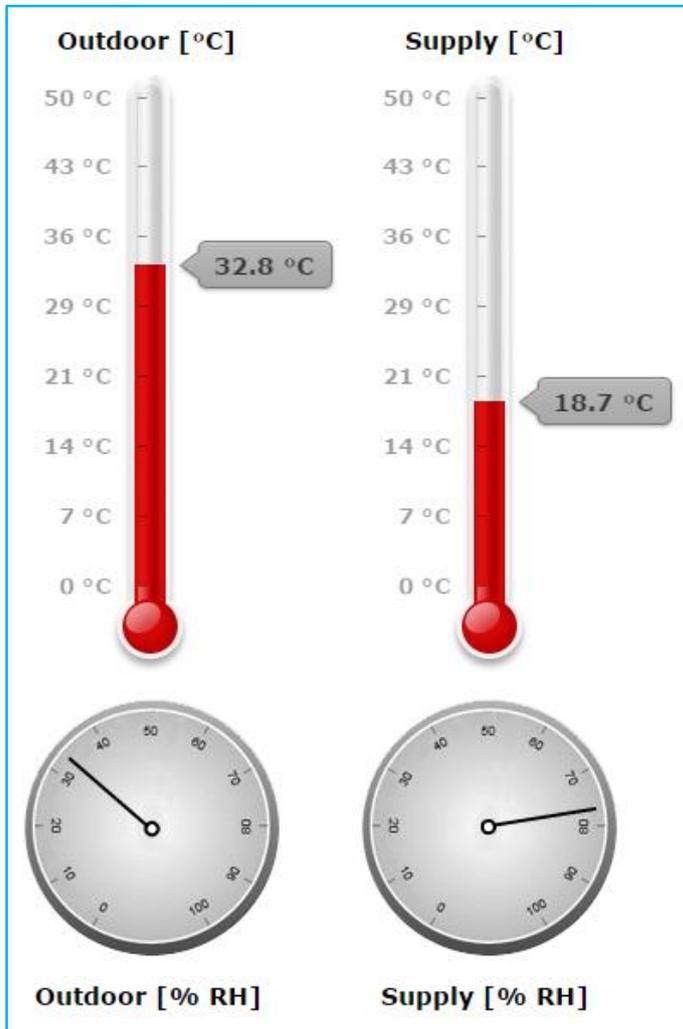
- In panels "Inlet airflow" and "Supply airflow" you can specify the amount of hot air that flows into the OXYCELL and the amount of cooled air that is actually being supplied, respectively.

- The "Inlet airflow" is the amount of hot air that flows into the primary (dry) channel of the OXYCELL.

- Part of the cooled air leaving the primary (dry) channel is branched off and led back into the secondary (wet) channel. The "Supply airflow" is the amount of cooled air that remains and can actually be used for cooling purposes.

- Panel "Results" shows an overview of the most interesting data.

Results

Supply temperature [°C]	18.7
Supply relative humidity [%]	76.8
Primary pressure drop [Pa]	366
Secondary pressure drop [Pa]	74
Primary air velocity [m/s]	2.7
Secondary air velocity [m/s]	1.1
Water consumption [L/h]	6.7
Wet bulb efficiency [%]	115.5

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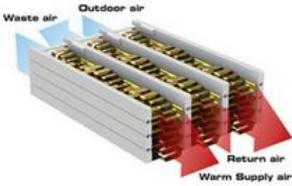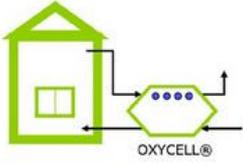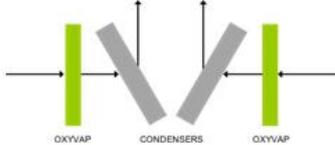Fax: +31 (0)572 349409

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- The panel at the right-hand side of the screen shows the (dry bulb) temperature and relative humidity of the outdoor and supply airstream.
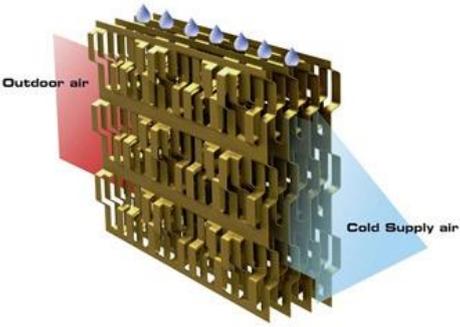
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SECTION 6 – STANDALONE OXYCELL IEC EXAMPLE

6.1 Screen "Choose the application"

Please select the application "Standalone Performance".

6.2 Screen "Choose the technology"

Please select the technology "OXYCELL".

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6.3 Screen "Choose the usage"

Please select the usage "Indirect Evaporative Cooling".

6.4 Screen "Air inlet conditions"

This screen allows you to specify the conditions of the airstreams flowing into the OXYCELL indirect evaporative cooler.

▪ You can select one of the most common standard conditions for testing the efficiency of the cooling process. CEC Title 20 is used as default.

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- Alternatively, you can manually specify the conditions of the "Outdoor air" (the airstream that is being cooled down) and the "Return air" (the airstream in which water is being evaporated) by choosing the dry bulb temperature and any of the other quantities.

6.5   Screen "Model and airflows"

This screen allows you to select the OXYCELL indirect evaporative cooler model, specify the airstreams and generate the results.

- In panel "Models" you can choose the model of the OXYCELL unit, of which the model number represents the maximum airflow that can be supplied, expressed in m³/h.
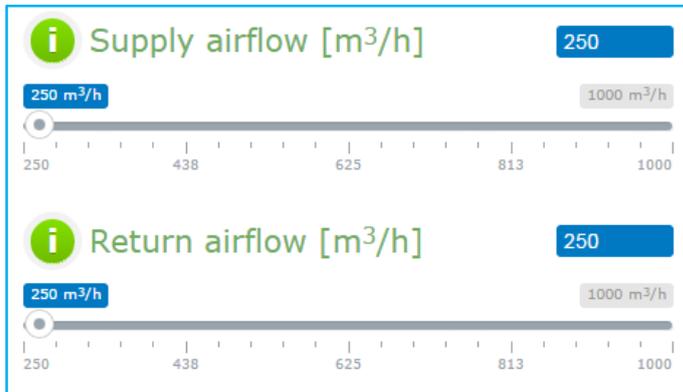
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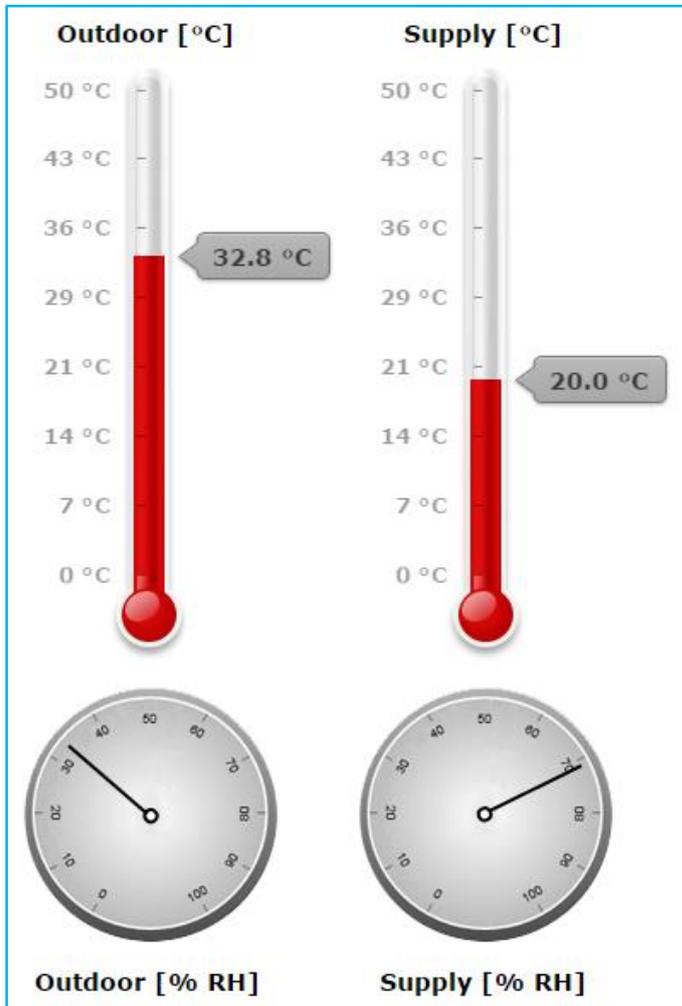Tel.: +31 (0)572 349400
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- In panels "Supply airflow" and "Return airflow" you can specify the amount of cooled air that is supplied, as well as the amount of air that is returned (for example from a room, office or datacentre).

- The "Supply airflow" is the amount of cooled air leaving the primary (dry) channel of the OXYCELL.

- The "Return airflow" is the amount of air that flows into the secondary (wet) channel of the OXYCELL. This airstream is constantly being humidified and kept in a permanent state of saturation, hereby extracting heat from the other airstream.

- Panel "Results" shows an overview of the most interesting data.

Results	
Supply temperature [°C]	20.0
Supply relative humidity [%]	71.0
Primary pressure drop [Pa]	148
Secondary pressure drop [Pa]	148
Primary air velocity [m/s]	1.6
Secondary air velocity [m/s]	1.6
Water consumption [L/h]	6.2
Wet bulb efficiency [%]	105.2

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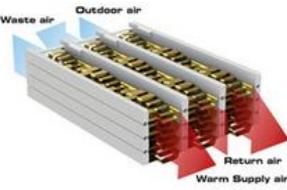The Netherlands
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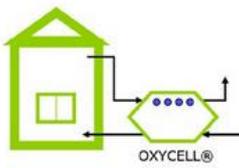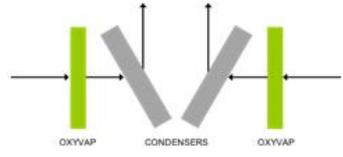- The panel at the right-hand side of the screen shows the (dry bulb) temperature and relative humidity of the outdoor and supply airstreams.
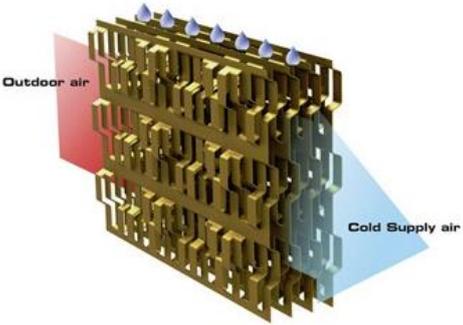
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SECTION 7 – STANDALONE OXYVAP EXAMPLE

7.1   Screen "Choose the application"

Please select the application "Standalone Performance".

Standalone Performance

Cooling characteristics of the OXYCELL indirect evaporative cooler and the OXYVAP direct evaporative cooler.

Select

Applied Performance

The OXYCELL indirect evaporative cooler and the OXYVAP direct evaporative cooler applied to cool a room under certain outdoor design conditions and heat load.

Select

Condenser Pre-cooling

The OXYVAP direct evaporative cooler applied to lower the inlet air temperature to the condenser coils of a conventional air conditioning system, hereby increasing the compressor efficiency.

Select

7.2   Screen "Choose the technology"

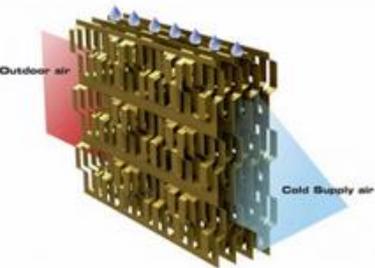Please select the technology "OXYVAP".

OXYCELL

The OXYCELL is a counter-flow heat exchanger, designed for heat recovery, indirect evaporative cooling and dew point cooling.

Select

OXYVAP

The OXYVAP is a direct evaporative cooling pad.

Select

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7.3   Screen "Choose the usage"

Please select the usage "Direct Evaporative Cooling".

7.4   Screen "Air inlet conditions"

This screen allows you to specify the conditions of the airstream flowing into the OXYVAP pad.

- You can select one of the most common standard conditions for testing the efficiency of the cooling process. CEC Title 20 is used as default.

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- Alternatively, you can manually specify the conditions of the "Outdoor air" (the airstream that is being cooled down and humidified) by choosing the dry bulb temperature and any of the other quantities. The conditions for the "Return air" are not relevant for this type of cooling, and therefore cannot be specified.
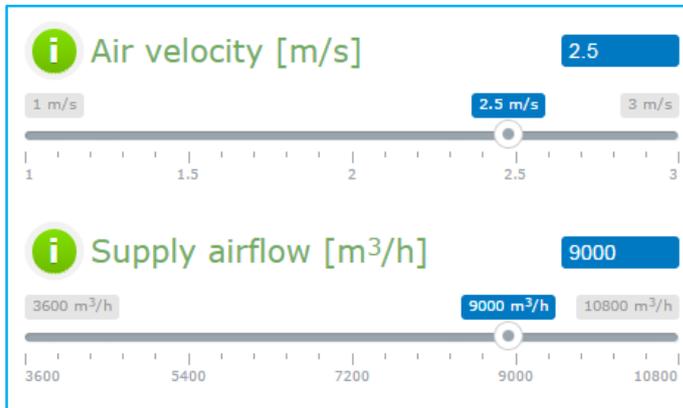

7.5 Screen "Model and airflows"

This screen allows you to dimension the OXYVAP pad, specify the airstream and generate the results.

- In panel "Finned surface area" you can specify the amount of finned surface area; this is the frontal surface area of the OXYVAP pad.

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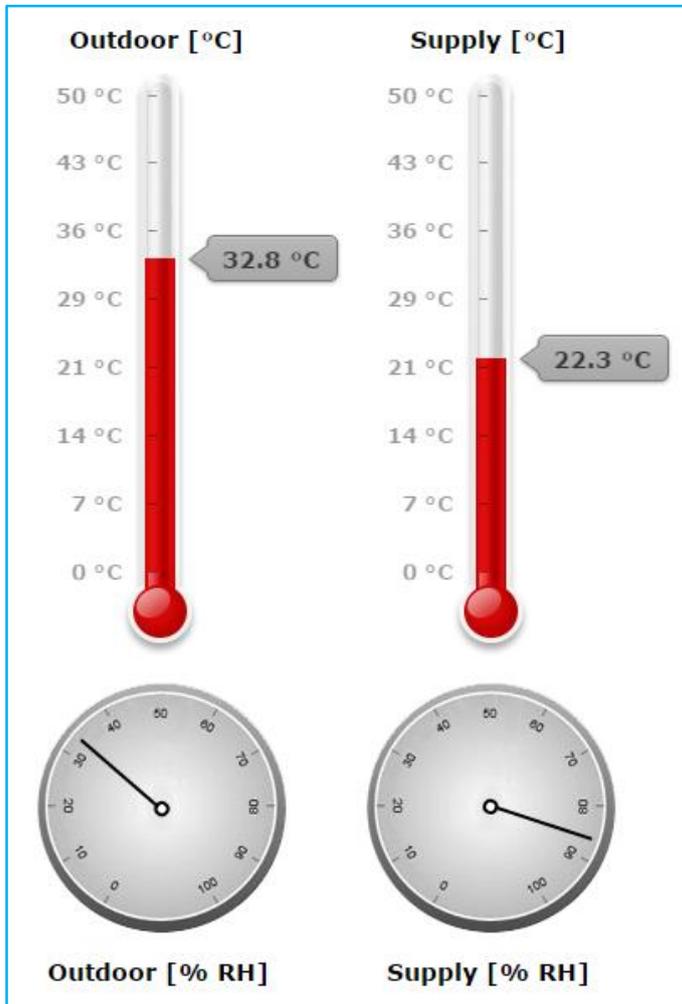Fax: +31 (0)572 349409

- Specify either the air velocity or the supply airflow through the OXYVAP pad. If one of these values is specified, the other will be calculated accordingly.

- The air velocity is the free-flowing velocity of the airstream, perpendicular to the finned material, just before it enters the OXYVAP pad.

- Panel "Results" shows an overview of the most interesting data.

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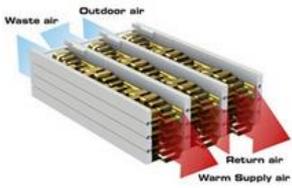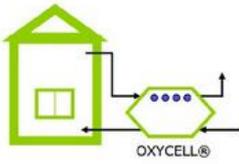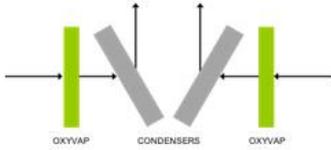Fax: +31 (0)572 349409

▪ The panel at the right-hand side of the screen shows the (dry bulb) temperature and relative humidity of the outdoor and supply airstreams.

SECTION 8 – APPLIED OXYCELL DPC AND IEC EXAMPLE

8.1   Screen "Choose the application"

Please select the application "Applied Performance".

8.2   Screen "Choose design conditions"

This screen allows you to specify the design conditions in three ways.

▪ You can select a location from the world map by zooming in or clicking on the green areas until you can select a location marked in blue. The design conditions for evaporative cooling for that specific location will then automatically be filled in in section "Conditions".

- Alternatively, you can select a location from the dropdown list shown in the section "Location".

- It is also possible to specify the conditions manually by choosing the dry bulb temperature and any of the other quantities.

- The default conditions are derived from the California Energy Commission 2012 Title 20 Appliance Efficiency Regulations.

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8.3   Screen "Specifications and results"

This screen allows you to choose the desired technology and usage, dimension a certain space to be cooled and generate the results.

▪ Please select the technology "OXYCELL" and choose either the usage "Dew Point Cooling" or "Indirect Evaporative Cooling".

▪ In panel "Models" you can choose the model of the OXYCELL unit, of which the model number represents the maximum airflow that can be supplied, expressed in m^3/h.

▪ In panel "Max. pressure drop" you can specify the upper limit for the pressure drop over the OXYCELL.

▪ When the usage "Dew Point Cooling" has been selected, the primary (dry) channel has a higher airflow than the secondary (wet) channel. Accordingly, the primary channel has a higher pressure drop. In this case, the chosen upper limit is related to the primary channel only.

▪ When the usage "Indirect Evaporative Cooling" has been selected, both channels have equal airflow and therefore equal pressure drop. The chosen upper limit is related to either channel.

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- You can specify a certain space to be cooled by choosing its dimensions and the heat load.

- When either the heat load or the specific heat load is changed, the other quantity is calculated accordingly.

- The occupied zone is the space in which people usually reside. The height marks the border between the occupied and the unoccupied zone.

- You can manually specify the maximum temperature that is allowed within the occupied zone. This is usually related to the human comfort level.

- Alternatively, you can select one of the most common maximum temperatures thought to be comfortable for human occupancy when combining ventilation and evaporative cooling.

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- You may choose to incorporate the principle of displacement ventilation, in which cooled air is supplied at floor level and hot air is extracted at the ceiling, such that there will be a temperature gradient in between (stratification).

- System using this principle can handle a higher heat load than with the conventional principle of mixing ventilation, since the highest temperatures will build up close to the ceiling, outside the occupied zone.

- Panel "Results" shows an overview of the most interesting data, as well as a schematic overview including (dry bulb) temperature, relative humidity and airflow. The figures below show the results for Dew Point Cooling (upper figure) and Indirect Evaporative Cooling (lower figure).

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SECTION 9 – APPLIED OXYVAP EXAMPLE

9.1   Screen "Choose the application"

Please select the application "Applied Performance".

9.2   Screen "Choose design conditions"

This screen allows you to specify the design conditions in three ways.

- You can select a location from the world map by zooming in or clicking on the green areas until you can select a location marked in blue. The design conditions for evaporative cooling for that specific location will then automatically be filled in in section "Conditions".

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- Alternatively, you can select a location from the dropdown list shown in the section "Location".

- It is also possible to specify the conditions manually by choosing the dry bulb temperature and any of the other quantities.

- The default conditions are derived from the California Energy Commission 2012 Title 20 Appliance Efficiency Regulations.

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9.3   Screen "Specifications and results"

This screen allows you to choose the desired technology and usage, dimension a certain space to be cooled and generate the results.

- Please select the technology "OXYVAP" and the usage "Direct Evaporative Cooling".

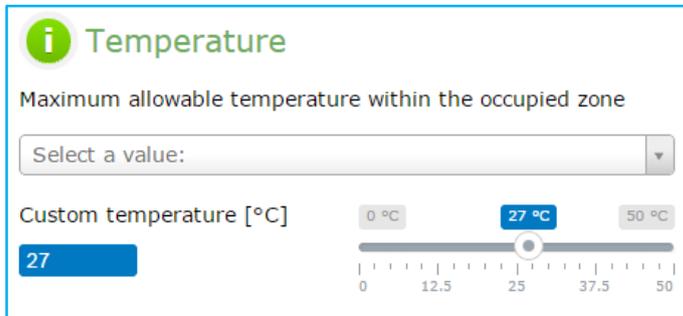- You can specify the velocity of the airstream flowing to the OXYVAP pad.

- The air velocity is the free-flowing velocity of the airstream, perpendicular to the finned material, just before it enters the OXYVAP pad.

- You can specify a certain space to be cooled by choosing its dimensions and the heat load.

- When either the heat load or the specific heat load is changed, the other quantity is calculated accordingly.

- The occupied zone is the space in which people usually reside. The height marks the border between the occupied and the unoccupied zone.

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- You can manually specify the maximum temperature that is allowed within the occupied zone. This is usually related to the human comfort level.

- Alternatively, you can select one of the most common maximum temperatures thought to be comfortable for human occupancy when combining ventilation and evaporative cooling.
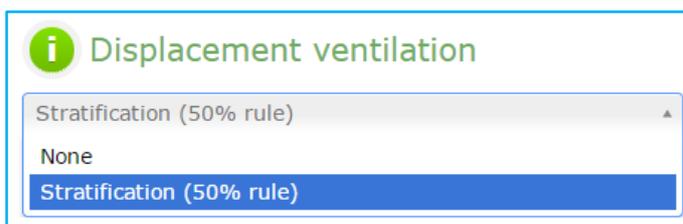

- You may choose to incorporate the principle of displacement ventilation, in which cooled air is supplied at floor level and hot air is extracted at the ceiling, such that there will be a temperature gradient in between (stratification).
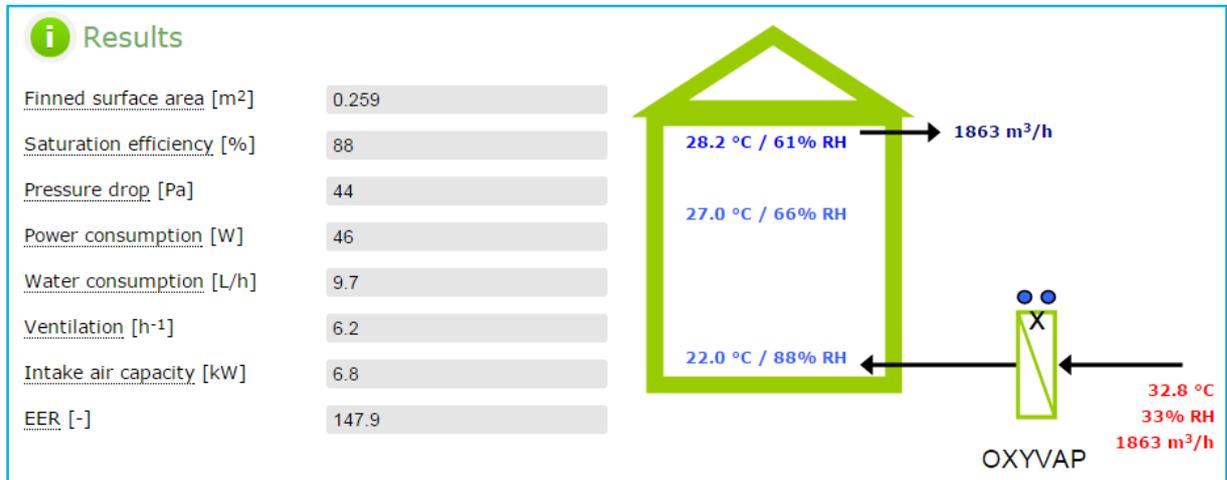

- System using this principle can handle a higher heat load than with the conventional principle of mixing ventilation, since the highest temperatures will build up close to the ceiling, outside the occupied zone.

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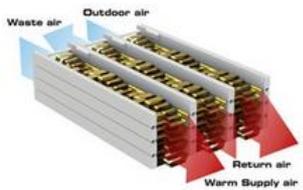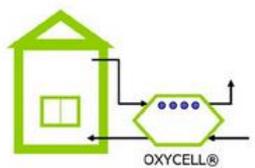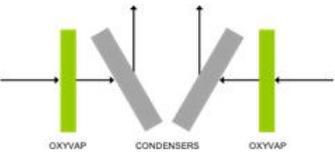The Netherlands
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▪ Panel "Results" shows an overview of the most interesting data, as well as a schematic overview including (dry bulb) temperature, relative humidity and airflow.

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SECTION 10 – CONDENSER PRE-COOLING EXAMPLE

10.1 Screen "Choose the application"

Please select the application "Condenser Pre-cooling".
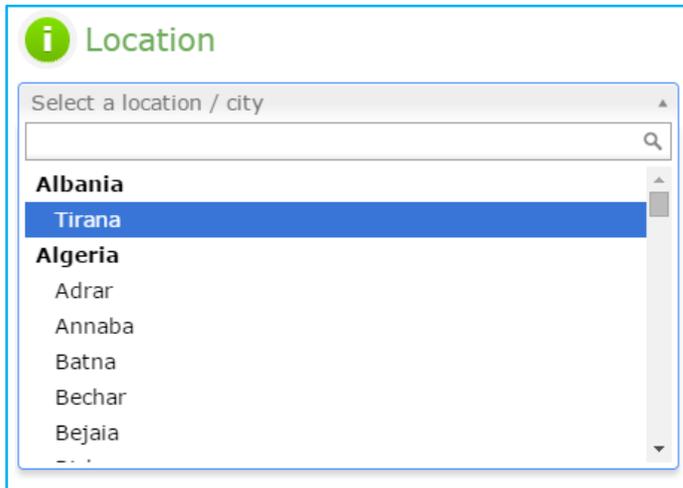

10.2 Screen "Choose design conditions"

This screen allows you to specify the design conditions in three ways.

▪ You can select a location from the world map by zooming in or clicking on the green areas until you can select a location marked in blue. The design conditions for evaporative cooling for that specific location will then automatically be filled in in section "Conditions".

- Alternatively, you can select a location from the dropdown list shown in the section "Location".

- It is also possible to specify the conditions manually by choosing the dry bulb temperature and any of the other quantities.

- The default conditions are derived from the California Energy Commission 2012 Title 20 Appliance Efficiency Regulations.

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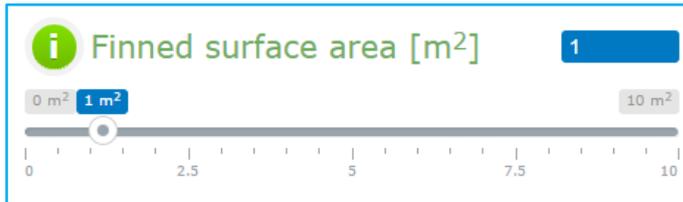Heesweg 37
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Tel.: +31 (0)572 349400
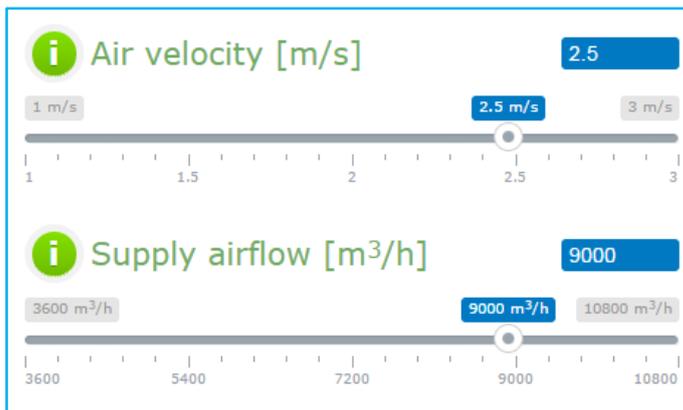Fax: +31 (0)572 349409

10.3 Screen "Specifications and results"

This screen allows you to dimension the OXYVAP pads, specify the airstreams and generate the results.

- In panel "Finned surface area" you can specify the amount of finned surface area; this is the combined frontal surface area of the two OXYVAP pads shown in the schematic overview.

- Specify either the air velocity or the combined supply airflow through the OXYVAP pads. If one of these values is specified, the other will be calculated accordingly.

- The air velocity is the free-flowing velocity of the airstreams, perpendicular to the finned material, just before they enter the OXYVAP pads.

- Panel "Results" shows an overview of the most interesting data.

Results	
Supply temperature [°C]	22.3
Supply relative humidity [%]	86
Saturation efficiency [%]	85
Pressure drop [Pa]	64
Power consumption [W]	322
Water consumption [L/h]	45.7
Increase of compressor efficiency [%]	16.9

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▪ A schematic overview of the results is shown in the panel below.